# *Anomalous Production of Gamma + Jets + MEt*

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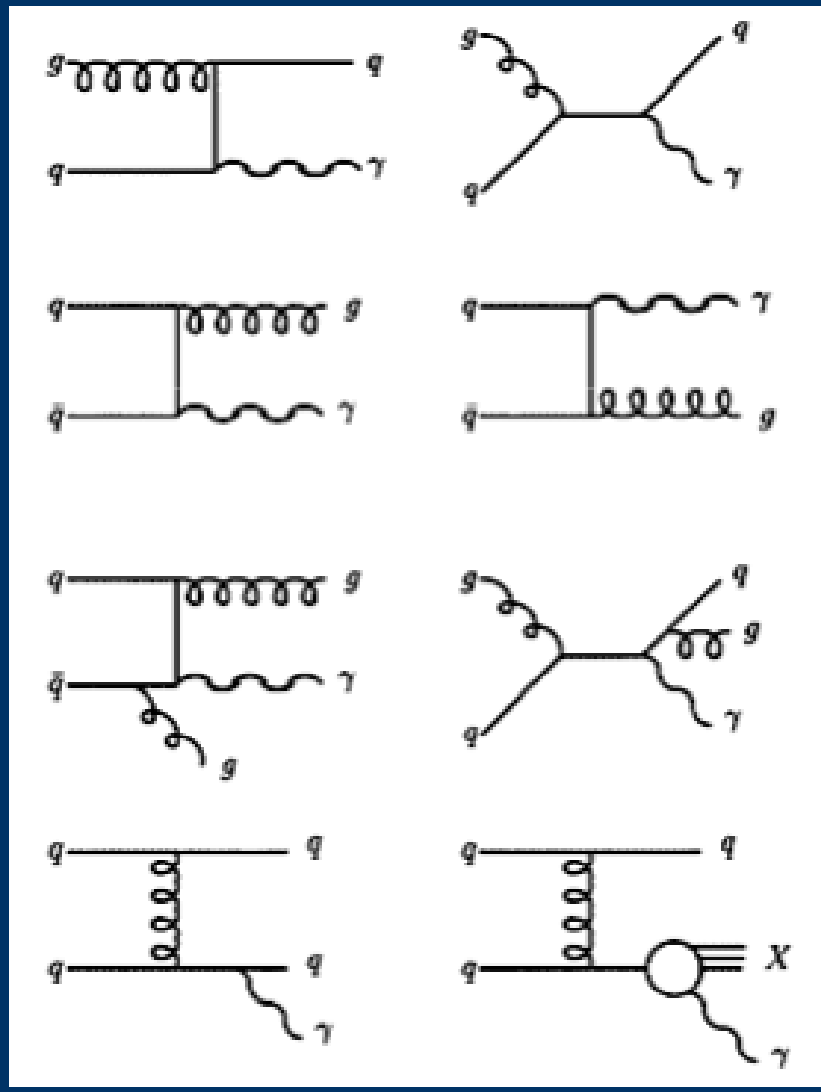
# Overview

- Work plan
- Triggers and Datasets
- Backgrounds
- Summary



# Work Plan

- Dealing with well known backgrounds
- Look at all possible distributions for new physics.
  - Kinematic Distributions
    - **MEt, Ht, Photon Et, Njet, Mass(pho-jet, di-jet), Jet Et etc.**
  - Kinematic Distributions for events with significant MEt
    - **MEt, Ht, Photon Et, Njet, Mass(pho-jet, di-jet), Jet Et etc.**

# *Work Plan ...*

- Use MEt resolution model to predict shape of fake MEt and to select events with significant MEt.
- Use 1/10 of the data set to optimize and test.
- Maybe, put limits on some models.

# Used Triggers and Datasets

- Triggers
  - PHOTON_25ISO, 50 AND 70
- Datasets
  - cph10d,0h,0i,0j(up to p11 for now)
- Photon MC
  - QCD group – PYTHIA- Pt min 22GeV, jqcdfh
- W/Z MC
  - EWK W->enu & Z/gamma*->ee

# Tight Photon Selection

> 30 GeV & CENTRAL

| Variable | Standard Cut | Loose Cut |
|---|---|---|
| Corrected Et | > 7 GeV or more | > 7 GeV or more |
| CES X and Z Fiducial | Ces \|X\|<21 cm,<br>9< Ces \|Z\|<230 cm | Ces \|X\|<21 cm,<br>9< Ces \|Z\|<230 cm |
| Had/Em | < 0.125 \|\| < 0.055 + 0.00045 * ECorr | < 0.125 |
| Cone 0.4 IsoEtCorr | EtCorr<20: < 0.1*EtCorr<br>EtCorr>20: < 2.0+0.02*(EtCorr-20.0) | EtCorr<20: < 0.15*EtCorr<br>EtCorr>20: < 3.0 |
| Chi2 (Strips+Wires)/2.0 | < 20 | None |
| N track (N3D) | <=1 | None |
| Track Pt | < 1+0.005*EtCorr GeV | < 0.25*EtCorr GeV |
| Cone 0.4 Track Iso | < 2.0+0.005*EtCorr | < 5.0 |
| 2nd CES cluster E*sin(theta)<br>(both strip and wire E individually) | EtCorr<18:< 0.14*EtCorr<br>EtCorr>18:< 2.4+0.01*EtCorr | None |

# *Jet Selection*

- Cone size = 0.4
- Remove EM objects from Jet list
- All jets are corrected up to level 6.
- Corrected Et > 15 GeV.
- Can be Central or Plug (eta<3)

Photon + 2Jets events ~ 606k

# *Event Selection*

- Require at least one of the triggers
- Pass good run  (v17_pho_02)
- Class 12 vertices >=1
- z position  < 60 cm
- Tight Photon+Jets>=1 (==2 for the rest of the talk)

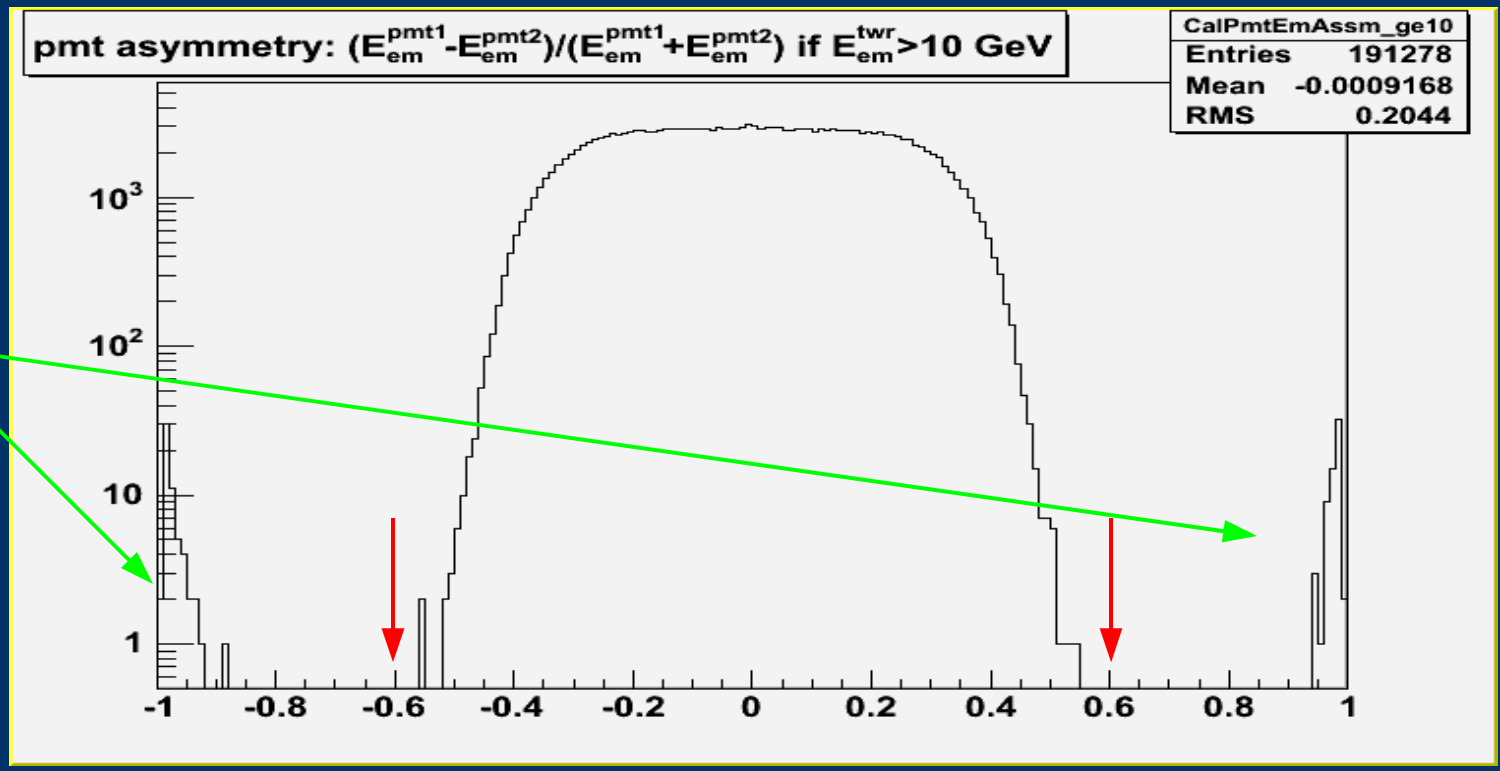
Photon + 2Jets events ~ 606k

# Backgrounds

- Non-collision
  - PMT Spikes
  - Beam Halo
  - Cosmics
- SM processes with real MEt, where e->gamma
  - Primarily Ws., smaller contributions from Z, di-boson and other
- QCD fake MEt

# Tackling PMT Spikes

- Reject 100% using PMT asymmetry.



# *Tackling Beam Halo*

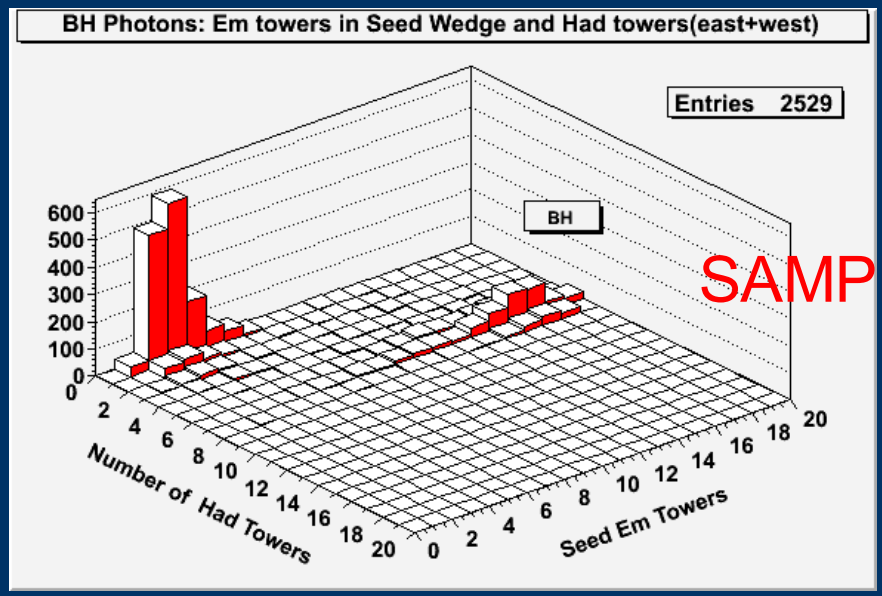
- Use topological cuts
- Looking from two ways.
  - EM time
  - Halo id cuts (cdfnote:8409) (HaloCuts)
- Use electrons to  measure inefficiency
- Need little more work to understand mis-id rates

# Tackling Beam Halo

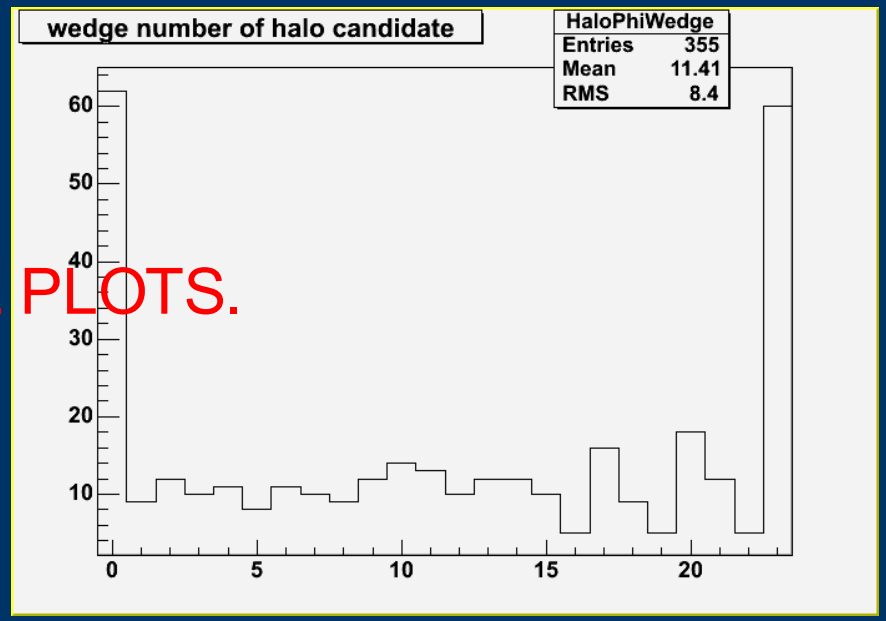
| Scenario | Selection Cuts |
|---|---|
| 0 | Seedwedge > 8 \|\| (eastNhad + westNhad) > 1 |
| 1 | Seedwedge > 4 && (eastNhad + westNhad) > 1 |
| 2 | seedwedge > 4 && (eastNhad + westNhad) > 2 |
| 3 | seedwedge > 7 && (eastNhad + westNhad) > 2 |
| 4 | seedwedge > 8 && (eastNhad + westNhad) > 2 |
| 5 | seedwedge > 8 && (eastNhad + westNhad) > 3 |

- **seedWedge** = number of EM towers ($E_T$>0.1 GeV) in same wedge as photon
- **Nhad** = number of plug HAD towers ($E_T$>0.1 GeV) in same wedge as photon

# Tackling Beam Halo

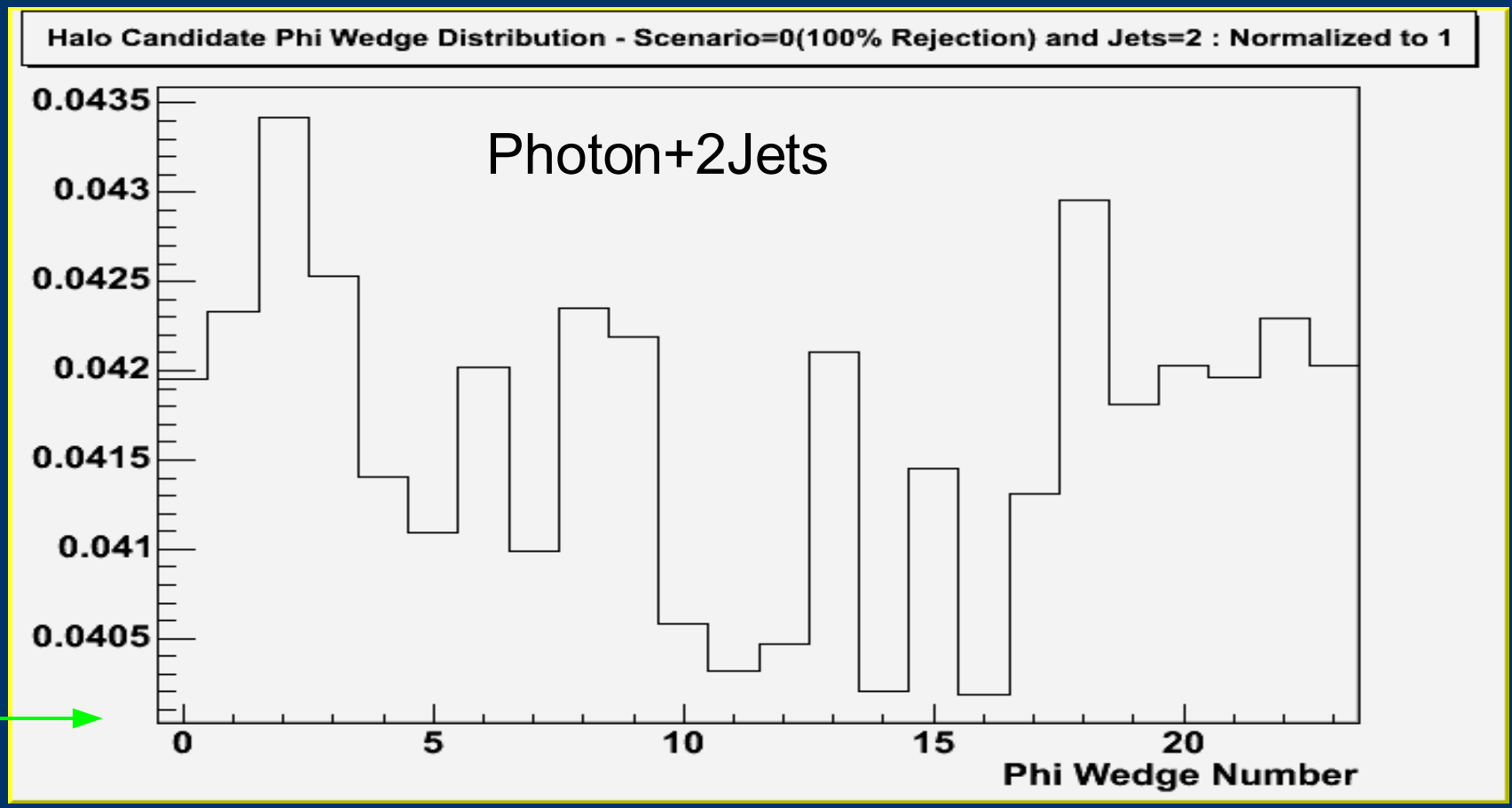



SAMPLE PLOTS.




VERTICES=0

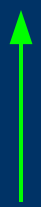
# Tackling Beam Halo




NOT ZERO

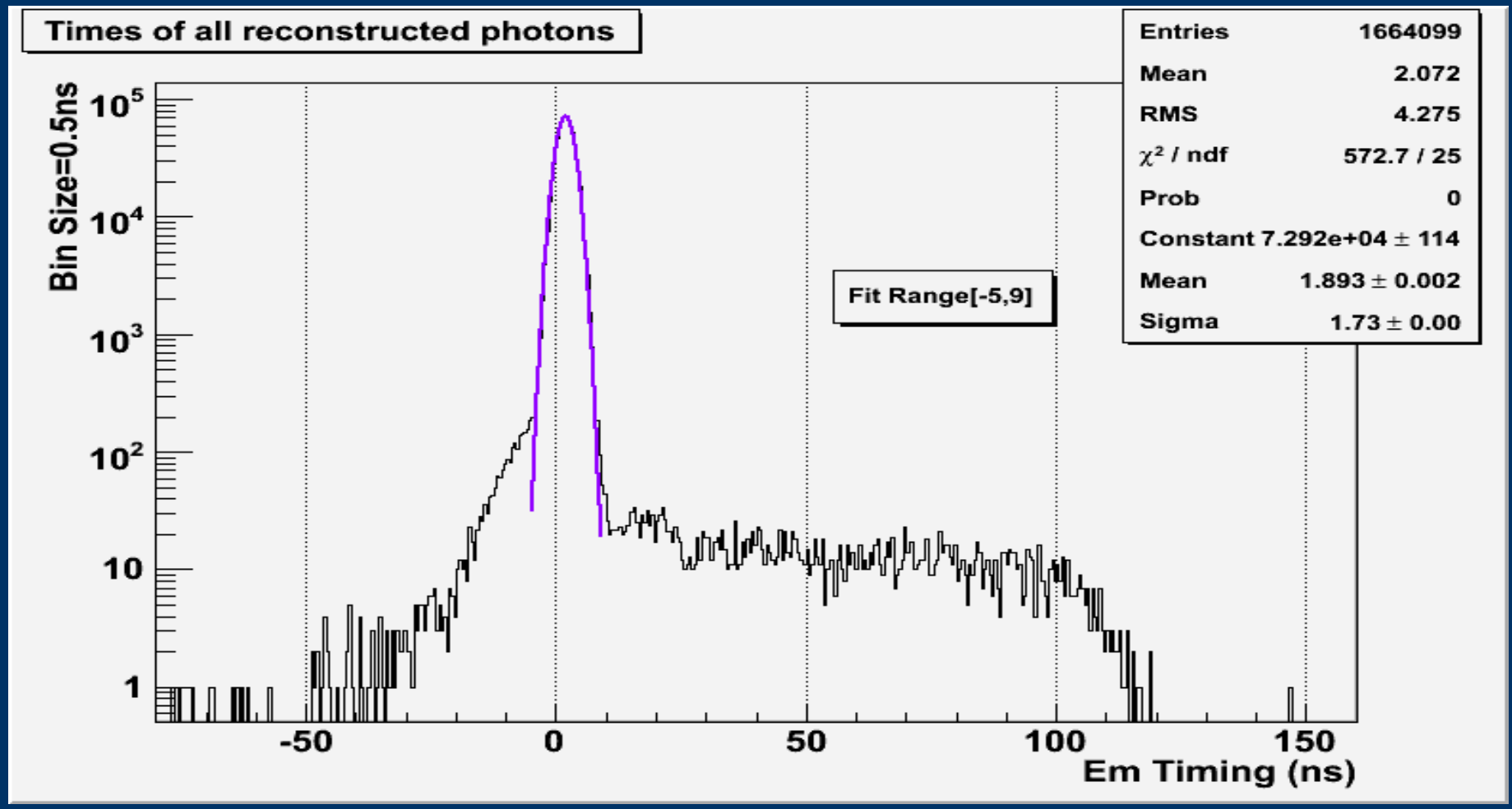
# *Beam Halo Estimates for Different Scenarios*

| BH Scenario | Inefficiency(%) | Identified | Expected(mis-id) |
|---|---|---|---|
| 0 | 7.38 | 47629 | 44744 |
| 1 | 6.29 | 39076 | 38169 |
| 2 | 1.66 | 11493 | 10082 |
| 3 | 0.58 | 3888 | 3525 |
| 4 | 0.35 | 2372 | 2114 |
| 5 | 0.09 | 667 | 572 |



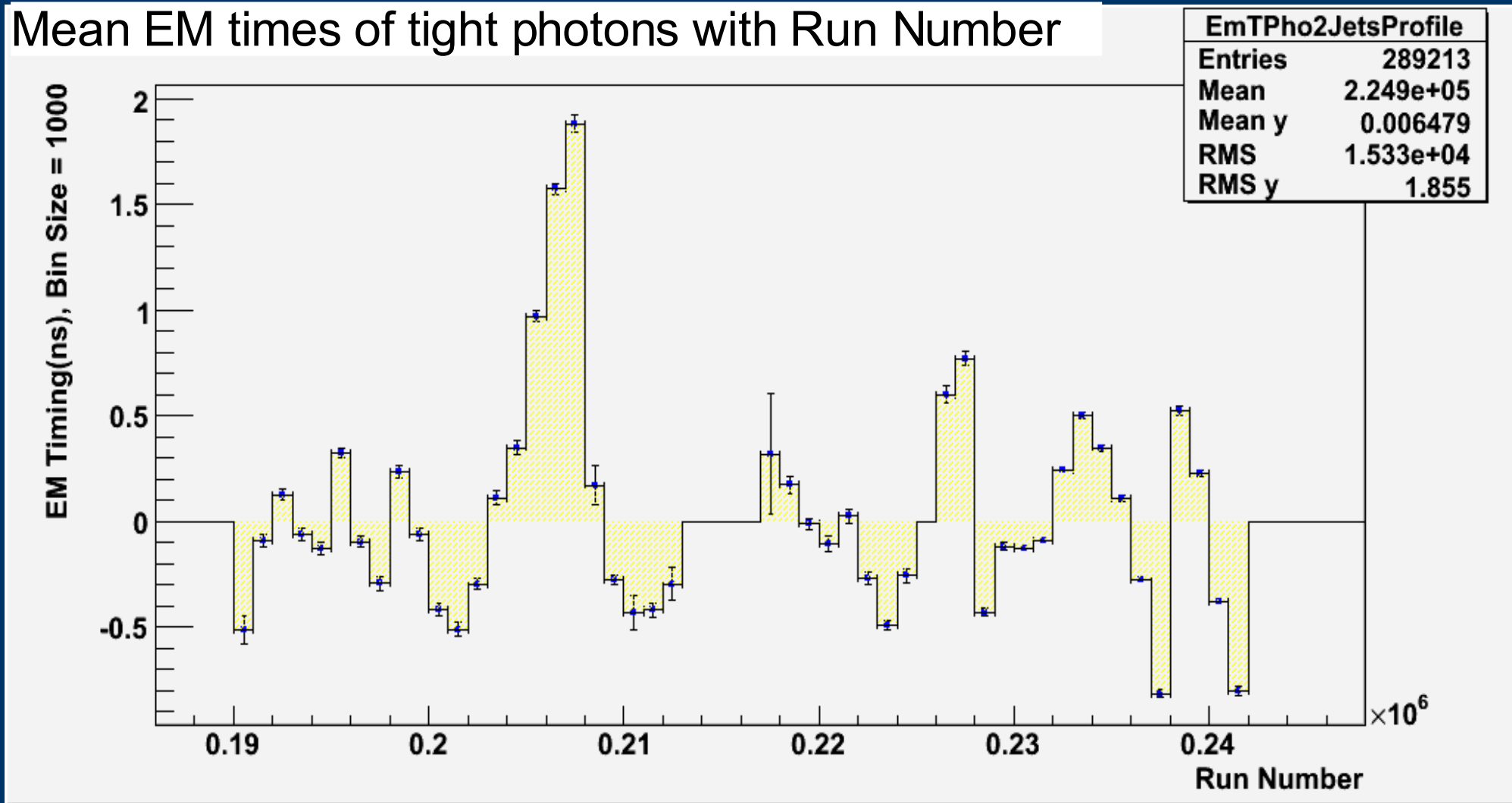
From electron data.

# EM Timing Corrections – All Photons

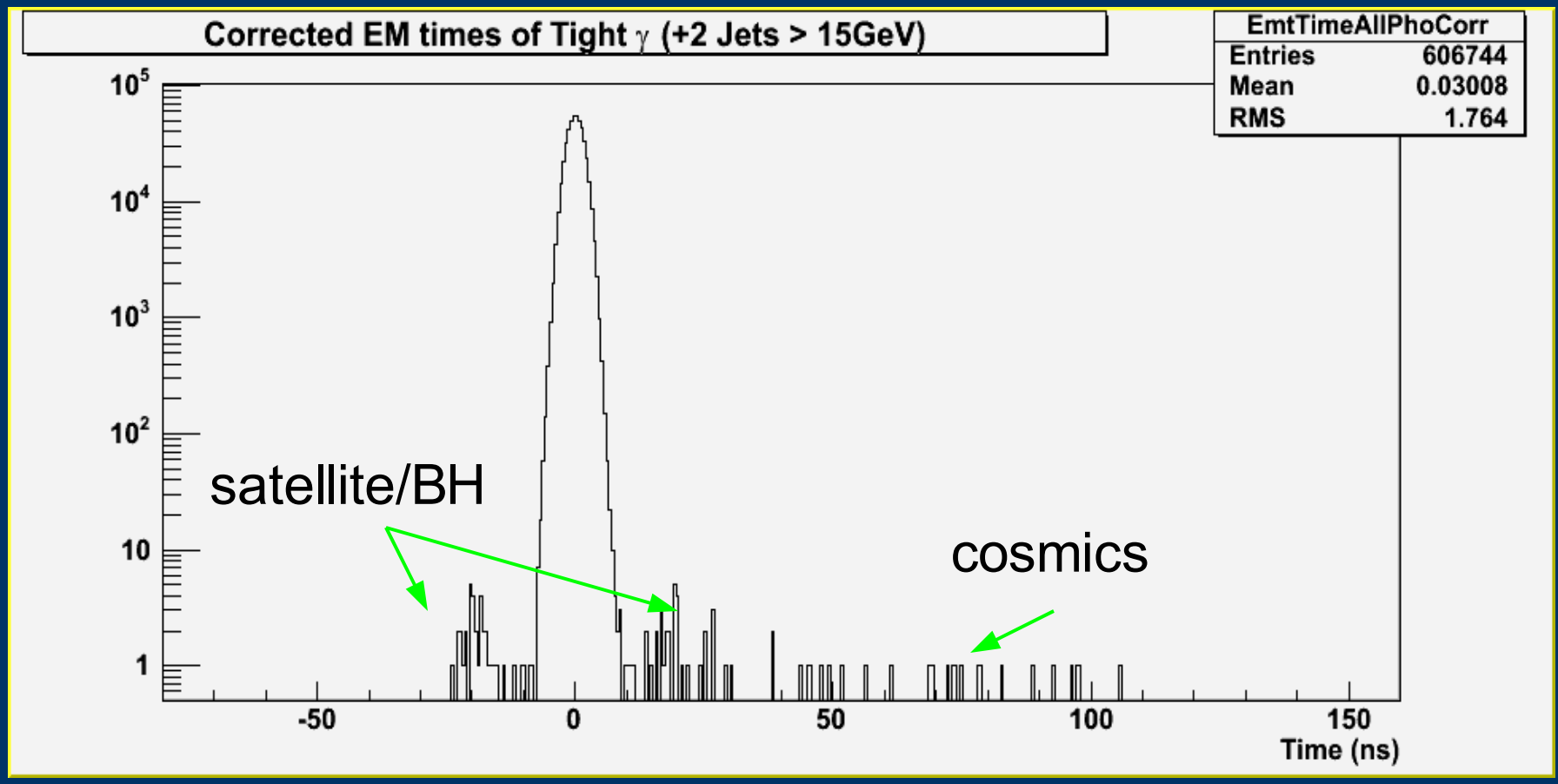


# EM Timing Corrections

Mean EM times of tight photons with Run Number



# Photon (+2Jets) EM Timing



# Tackling Cosmics

- Used corrected EM timing (Many thanx to Max)
- Time window >30ns and <130ns
  - ~60% cosmics with Trackless Muon stubs (within 30 degree cone of the photon)
  - Use this to estimate the remainder in 400pb-1 that has no timing info
  - We expect < 22 events

# *Tackling Electron Background*

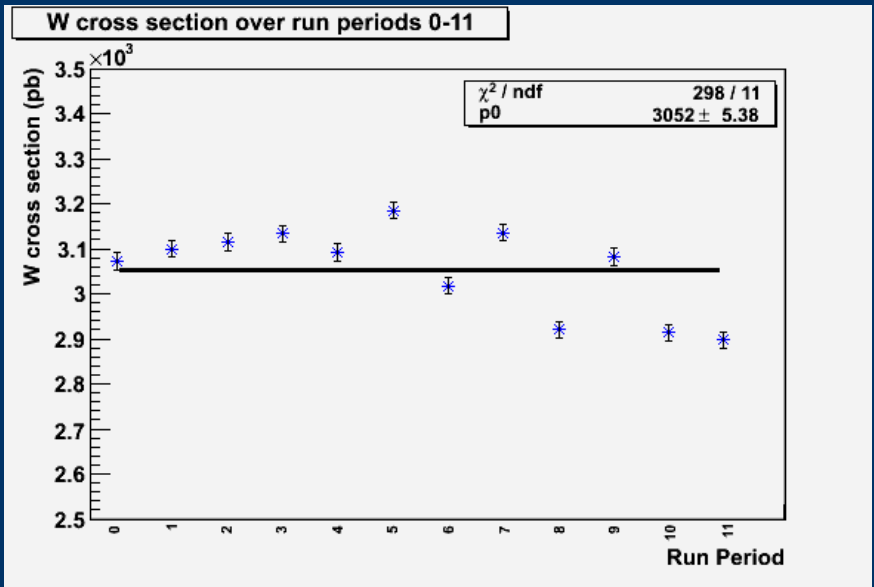
- Problem is e faking gamma
- Use Phoenix rejection (~60% when Et >35GeV)
- To estimate, use e->gamma fake rate from Sasha et.al. - cdfnote 8220.
  - tau fake contribution is very small for Et>30GeV
- Estimate of electrons left in the sample: e+2Jets:
  - **291.079 +/- 1.455(stat) +/- 34.675(sys)**
  - Fake rate uncertainty due to
    - Fake rate itself.
    - Fake electrons
    - statistics

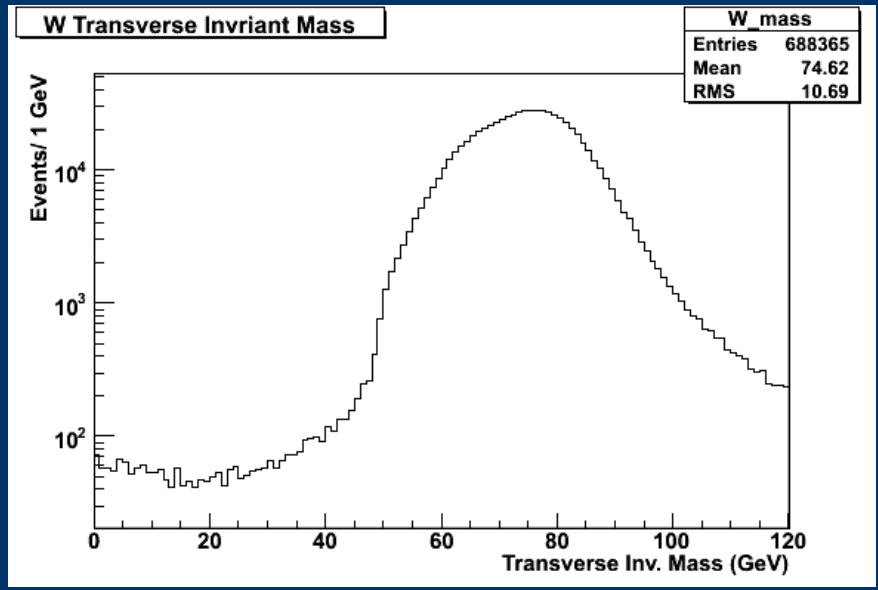
# Photon-like electron id cuts

| Variable | Cut value |
|---|---|
| detector | central |
| conversion | No |
| corrected $E_T$ | $> 30$ GeV |
| CES fiduciality | $\lvert X_{CES}\rvert \leq 21$ cm<br>$9$ cm $\leq \lvert Z_{CES}\rvert \leq 230$ cm |
| average CES $\chi^2$ | $\leq 20$ |
| Had/Em | $\leq 0.055 + 0.00045 \times E$ |
| $E_T^{Iso(corr)}$ in cone 0.4 | $\leq 0.1 \times E_T$ if $E_T < 20$ GeV<br>$\leq 2.0 + 0.02 \times (E_T - 20)$ if $E_T \geq 20$ GeV |
| N3D tracks in cluster | $= 1, 2$ |
| $E/p$ of $1^{st}$ track | $0.8 \leq E/P \leq 1.2$ if $P_T < 50$ GeV<br>no cut if $P_T \geq 50$ GeV |
| $2^{nd}$ track $p_T$ if N3D $= 2$ | $\leq 1.0 + 0.005 \times E_T$ |
| $TrkIso0.4 - P_T^{1^{st}trk}$ | $\leq 2.0 + 0.005 \times E_T$ |
| $E_T$ of $2^{nd}$ CES cluster (wire and strip) | $\leq 0.14 \times E_T$ if $E_T < 18$ GeV<br>$\leq 2.4 + 0.01 \times E_T$ if $E_T \geq 18$ GeV |
| $\lvert\Delta z\rvert = z_{vtx} - z_{trk}$ | $\leq 3$ cm |

# *Photon-like Electron ID Validation – W Cross section*

**3052 pb (hep-ex/0406078v2:** 2782+/14+/59)

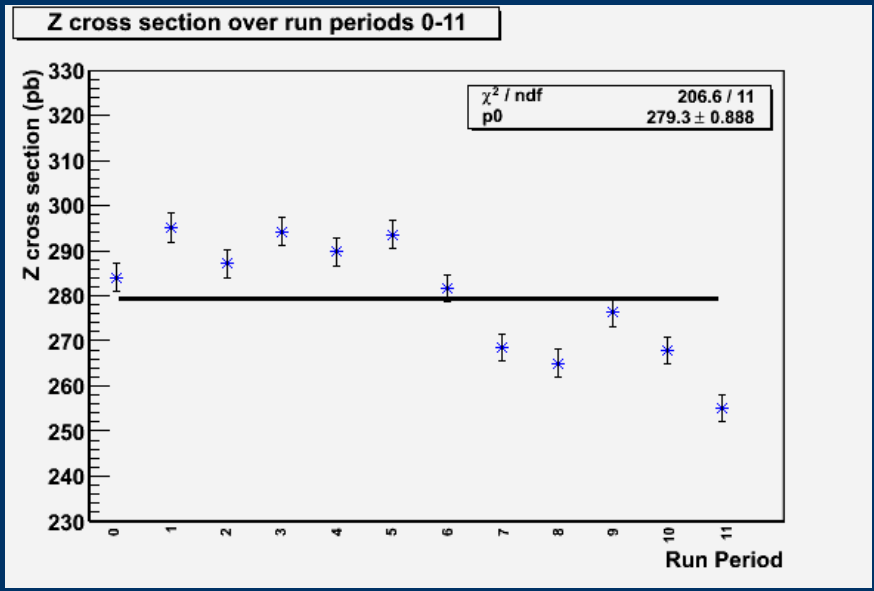


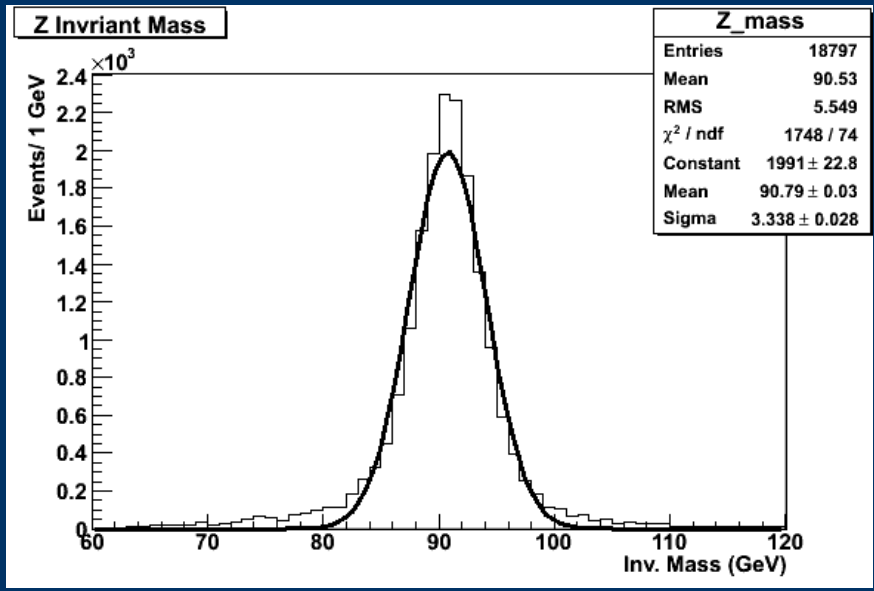




**One electron & Met>20GeV, Lum: 2034 pb, good run list v.17_pho_02**

# *Photon-like Electron ID Validation – Z Cross section*

**279.3. pb (hep-ex/0406078v2**: 255.2+/3.9+/6 pb)




**Two electrons, Lum: 2034 pb, good run list v.17_pho_02**

# *Not-so Final Numbers!*

| Background | Expect |
|---|---|
| Halo (Scen. 4) | 2114 |
| Electron | 291 |
| Cosmic | <22 |

# Summary

- Most of the backgrounds are well understood.
- Need to look at 1/10 test.
- Look at stuff with high MEt significance.
- Include p12 data.
- Find new physics.

*Thank you.*